Assimilation of SMOS retrieved soil moisture into the Land Information System

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Soil moisture is an important variable for weather prediction during warm-season months because of its influence on evaporation and surface heat fluxes. It is also of critical importance for drought and flood monitoring and prediction and for public health applications such as monitoring vector-borne diseases. The Microwave Imaging Radiometer using Aperture Synthesis (MIRAS) instrument aboard the Soil Moisture and Ocean Salinity (SMOS) satellite is an L-band radiometer that can estimate soil moisture in roughly the top 2.5 cm of soil with a target volumetric accuracy of 4% at a footprint resolution of 35-50 km. The NASA Short-term Prediction Research and Transition (SPoRT) Center has implemented the assimilation of SMOS Level 2 soil moisture retrievals into version 3.2 of the Noah land surface model within the NASA Land Information System (LIS), an integrated land surface modeling and data assimilation software framework. Data assimilation is handled within LIS via an Ensemble Kalman Filter (EnKF) algorithm.

Model error covariance (and hence the weight of model background relative to observations) within the EnKF is governed by the ensemble spread. We present our findings from experiments with forcing, observation, and state perturbations in order to achieve a representative model uncertainty.

To remove bias between the model and observations, we apply a cumulative distribution function (CDF) based bias correction to the SMOS retrievals. Results are presented from data assimilation experiments using degraded forcing data, with validation performed against a model “truth” run using high-quality forcing data. This will quantify the benefit of SMOS data assimilation in the absence of dense rain gauge and radar networks (of interest for sparsely-instrumented regions and for global applications). Experience gained from SMOS assimilation will be used to implement data assimilation of observations from NASA’s Soil Moisture Active-Passive (SMAP) satellite, scheduled to be launched in November 2014.

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